Alabama Department of Environmental Management

Basin Assessment Site

Rivers and Streams Monitoring Program

2007 Monitoring Summary

Buck Creek below dam in Helena off Hwy 261 (Shelby County) (33.29694/-86.84263)

BACKGROUND

Buck Creek at B-1 is one of 94 sites monitored annually to identify long-term trends in water quality and to provide data for the development of Total Maximum Daily Loads (TMDL) and water quality criteria.

The Alabama Department of Environmental Management (ADEM) selected the Buck Creek watershed for biological and water quality monitoring as part of the 2007 Assessment of the Black Warrior and Cahaba (BWC) River Basins. The objectives of the BWC Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the BWC basin group.

In 2004, a 2.9 mile segment of Buck Creek from Cahaba Valley Creek downstream to the Cahaba River was placed on the 303(d) list for pathogens from stormwater runoff/storm sewers. TMDL's for Buck Creek were approved in 2009.

Figure 1. Buck Creek at B-1, May 16, 2007.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Buck Creek is a small *Fish & Wildlife (F&W)* stream located in the city of Helena in the Cahaba River basin. Based on the 2000 Land Cover Dataset, landuse within the watershed is primarily forest (52%), with some open development (33%). The presence of deciduous forests are characteristic of streams in the Southern Limestone/ Dolomite Valleys and Low Rolling Hills. As of February 23, 2011, ADEM's NPDES Management database showed a total of 342 permitted discharges in the watershed.

REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Buck Creek at B-1 is a high-gradient, cobble-bottomed stream (Figure 1). Overall habitat quality was categorized as *optimal* for supporting macroinvertebrate communities.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Cahaba River
Drainage Area (mi^2)		71
Ecoregion[a]		67f
% Landuse		
Open water		<1
Wetland	Woody	<1
Forest	Deciduous	42
	Evergreen	6
	Mixed	4
Shrub/scrub		2
Grassland/herbaceous		3
Pasture/hay		5
Cultivated crops		1
Development	Open space	15
	Low intensity	13
	Moderate intensity	4
	High intensity	1
Barren		2
Population/km^2[b]		279
# NPDES Permits[c]	**TOTAL**	342
401 Water Quality Certification		3
Construction Stormwater		292
Mining		8
Industrial General		23
Industrial Individual		1
Municipal Individual		14
Underground Injection Control		1

a.Southern Limestone/Dolomite Valleys and Low Rolling Hills
b.2000 US Census
c.#NPDES permits downloaded from ADEM's NPDES Management System database, February 23, 2011

Table 2. Physical characteristics of Buck Creek at B-1, May 16, 2007.

Physical Characteristics		
Width (ft)		50
Canopy cover		Estimate 50/50
Depth (ft)		
	Riffle	1.5
	Run	2.5
	Pool	3.0
% of Reach		
	Riffle	30
	Run	40
	Pool	30
% Substrate		
	Boulder	10
	Cobble	60
	Gravel	23
	Sand	1
	Silt	4
	Organic Matter	2

BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each metric is scored on a 100 point scale. The final score is the average of all individual metric scores. Metric results indicated the macroinvertebrate community to be in *very poor* condition (Table 4).

Table 3. Results of the habitat assessment conducted in Buck Creek at B-1, May 16, 2007.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	74	Optimal (> 70)
Sediment Deposition	71	Optimal (> 70)
Sinuosity	85	Optimal (> 84)
Bank and Vegetative Stability	75	Sub-optimal (60-74)
Riparian Buffer	56	Marginal (50-69)
Habitat Assessment Score	**174**	
% Maximum score	**73**	**Optimal (> 70)**

Table 4. Results of the macroinvertebrate bioassessment conducted in Buck Creek at B-1, May 16, 2007.

Macroinvertebrate Assessment Results			
	Results	**Scores (0-100)**	**Rating**
Taxa richness measures			
# Ephemeroptera (mayfly) genera	4	33	Poor (23-46)
# Plecoptera (stonefly) genera	0	0	Very Poor (<16)
# Trichoptera (caddisfly) genera	7	58	Fair (45-66)
Taxonomic composition measures			
% Non-insect taxa	23	9	Very Poor (<24.7)
% Non-insect organisms	29	24	Very Poor (<31.3)
% Plecoptera	0	0	Very Poor (<6.56)
Tolerance measures			
Beck's community tolerance index	8	29	Poor (20.2-40.9)
WMB-I Assessment Score	**---**	**22**	**Very Poor (<24)**

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, herbicides (atrazine), and semi-volatile organics) during January through December of 2007 to help identify any stressors to the biological communities. In situ measurements showed concentrations of dissolved arsenic that exceeded the human health criterion in all four samples collected at the station. Dissolved mercury concentrations exceeded the *F&W* aquatic life use criterion in one of four samples collected. Median values for chlorides, total dissolved solids, specific conductance, hardness, alkalinity, and nutrients (nitrate+nitrite-nitrogen, total kjeldahl nitrogen, total nitrogen, dissolved reactive phosphorus, and total phosphorus) were above concentrations expected in this ecoregion.

SUMMARY

The habitat assessment for Buck Creek at B-1 resulted in an *optimal* rating. The bioassessment results indicated the macroinvertebrate community to be in *very poor* condition. Water quality data suggest that elevated concentrations of nitrogen, phosphorus and some dissolved metals (arsenic and mercury) may pose a potential concern for biological communities in the stream reach. Total dissolved solids, conductivity, alkalinity, and harness were also elevated.

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Table 5. Summary of water quality data collected January-December, 2007. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value this value.

Parameter	N	Min	Max	Med	Avg	SD	E
Physical							
Temperature (°C)	12	11.1	27.4	19.6	20.0	5.3	
Turbidity (NTU)	12	0.8	10.0	4.5	4.7	2.7	
Total Dissolved Solids (mg/L)	12	215.0	331.0	263.5 M	263.6	30.4	
Total Suspended Solids (mg/L)	12	< 1.0	10.0	4.0	4.5	3.0	
Specific Conductance (µmhos)	12	287.0	548.0	457.9 G	443.0	77.4	
Hardness (mg/L)	12	143.0	194.0	167.0 G	166.2	17.5	
Alkalinity (mg/L)	12	140.5	236.1	161.5 M	171.7	29.2	
Stream Flow (cfs)	12	13.4	114.0	19.4	34.7	30.5	
Chemical							
Dissolved Oxygen (mg/L)	12	7.6	13.0	10.4	10.1	2.0	
pH (su)	12	7.8	8.2	8.0	8.0	0.1	
Ammonia Nitrogen (mg/L)	12	< 0.015	0.188	0.022	0.039	0.051	
Nitrate+Nitrite Nitrogen (mg/L)	12	0.349	3.566	1.643 M	1.838	0.906	
J Total Kjeldahl Nitrogen (mg/L)	12	0.247	1.340	0.550 M	0.633	0.334	
J Total Nitrogen (mg/L)	12	1.531	3.813	2.268 M	2.471	0.761	
Dissolved Reactive Phosphorus (mg/L)	12	< 0.004	1.668	0.791 M	0.812	0.423	
J Total Phosphorus (mg/L)	12	0.413	1.820	0.908 M	0.920	0.406	
CBOD-5 (mg/L)	12	< 0.2	2.9	0.7	0.9	0.7	
Chlorides (mg/L)	12	8.6	34.7	22.0 M	22.5	7.0	
Atrazine (µg/L)	1			<	0.05		
Total Metals							
Aluminum (mg/L)	4	< 0.060	0.383	0.066	0.136	0.165	
Iron (mg/L)	4	< 0.050	0.150	0.104	0.096	0.052	
Manganese (mg/L)	4	< 0.042	0.075	0.055	0.052	0.023	
Dissolved Metals							
Aluminum (mg/L)	4	< 0.050	0.288	0.025	0.091	0.132	
Antimony (µg/L)	4	< 10.0	< 10.0	5.0	5.0	0.0	
Arsenic (µg/L)	4	0.6	1.7 H	1.2	1.2	0.5	4
Cadmium (mg/L)	4	< 0.002	< 0.015	0.004	0.004	0.004	
Chromium (mg/L)	4	< 0.002	< 0.050	0.013	0.013	0.014	
Copper (mg/L)	4	< 0.007	< 0.050	0.014	0.014	0.012	
Iron (mg/L)	4	< 0.006	< 0.050	0.016	0.016	0.011	
Lead (µg/L)	4	< 0.5	< 2.0	0.2	0.4	0.4	
Manganese (mg/L)	4	< 0.020	0.023	0.010	0.013	0.006	
Mercury (µg/L)	4	< 0.010	0.032 A	0.010	0.016	0.011	1
Nickel (mg/L)	4	0.003	< 0.050	0.016	0.015	0.012	
Selenium (µg/L)	4	< 0.3	0.6	0.2	0.3	0.2	
Silver (mg/L)	4	< 0.005	< 0.050	0.002	0.008	0.011	
Thallium (µg/L)	3	< 0.7	< 0.7	0.4	0.4	0.0	
Zinc (mg/L)	4	< 0.017	< 0.050	0.017	0.017	0.010	
Biological							
Chlorophyll a (ug/L)	12	< 1.00	32.60	0.50	3.52	9.19	
J Fecal Coliform (col/100 mL)	12	8	236	53	73	66	

E=# of samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 67f; H=*F&W* human health criterion exceeded; J=estimate; M=value > 90% of all data collected within ecoregion 67f ; N=# samples